Distillers Grains Technology Council Symposium
Minneapolis, MN
May 15-16, 2013

UNDERSTANDING THE USE OF DISTILLERS CO-PRODUCTS AS ANIMAL FEEDS IN THE U.S.

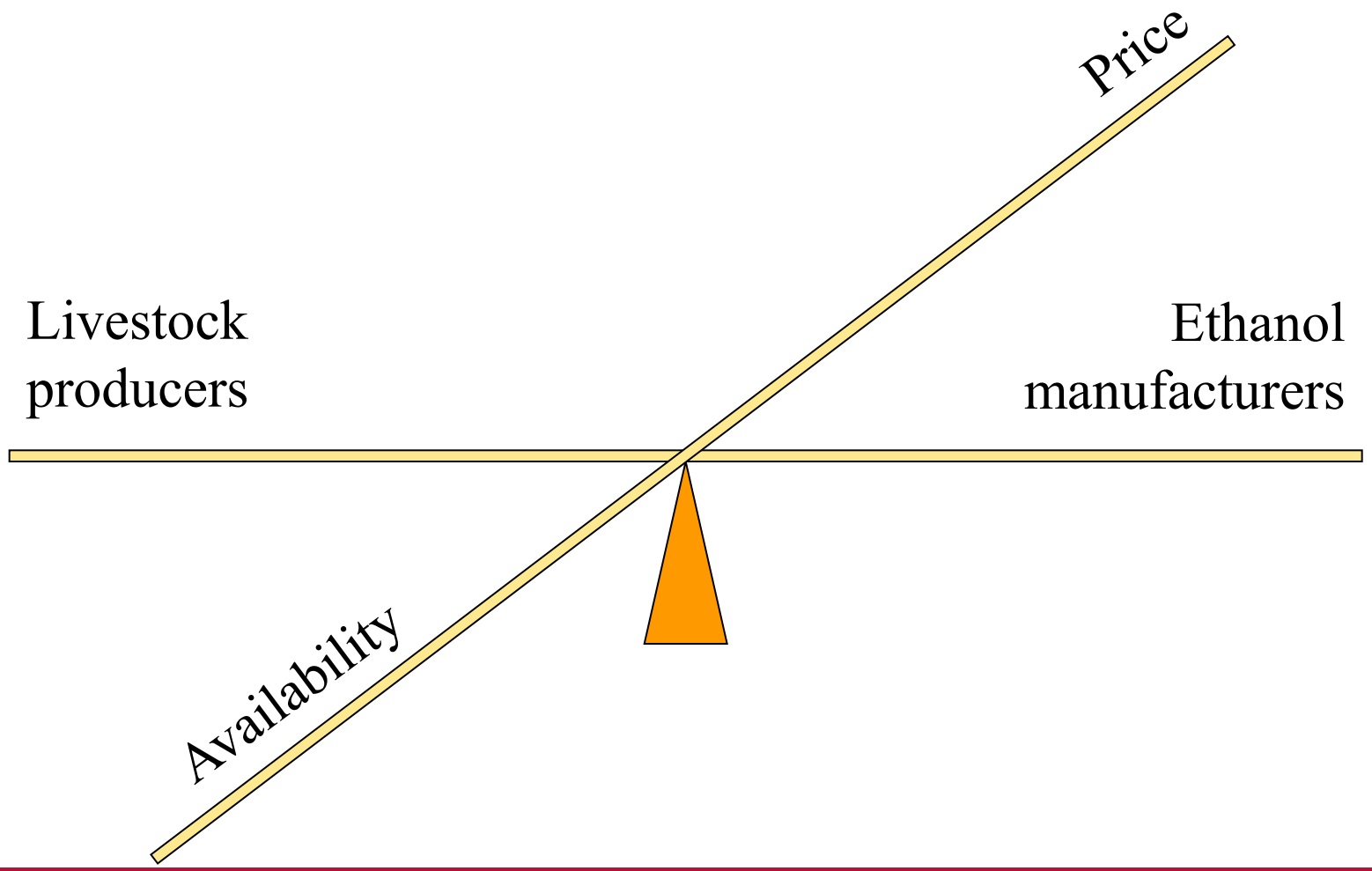
Kurt A. Rosentrater, Ph.D.
Assistant Professor
Department of Agricultural and Biosystems Engineering
Iowa State University

Overview

- What do we know?

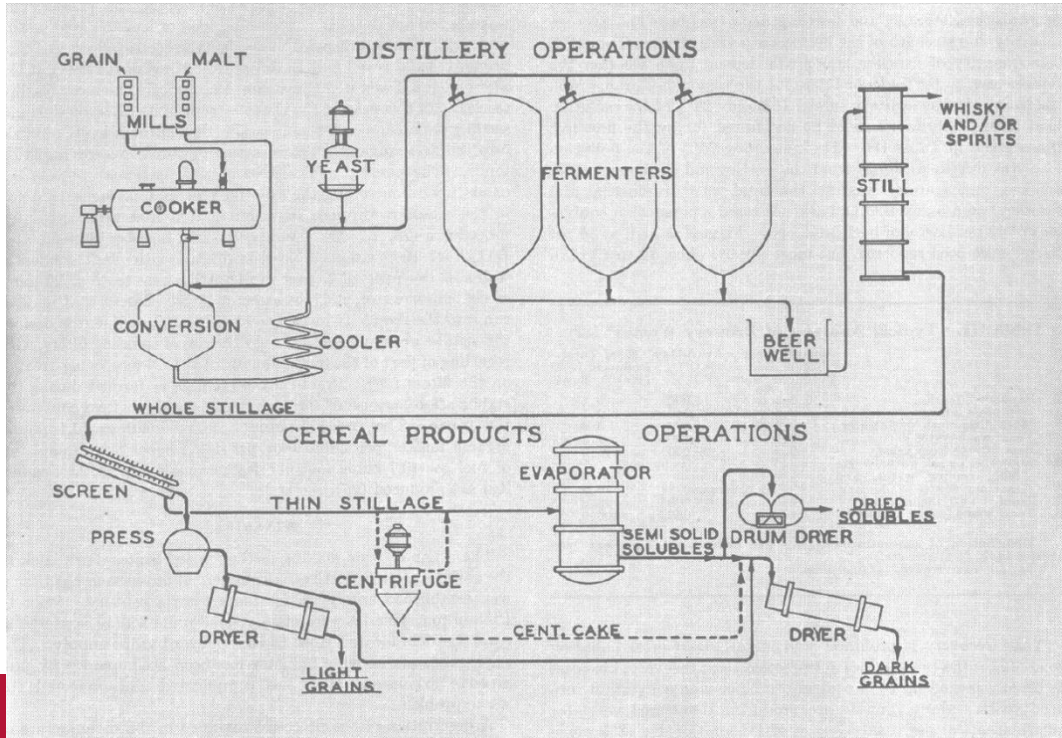
- What don't we know?
  - Previous studies & surveys
  - Pilot study of SD Dairy Producers
  - Nationwide study of livestock producers
  - Nationwide study of ethanol plants

Overview


Price
Livestock producers
Ethanol manufacturers
Availability

What do we know?

- “Grain distillers have developed equipment and an attractive market for their recovered grains” (Boruff, 1947)
- “Distillers are recovering, drying, and marketing their destarched grain stillage as distillers dried grains and dried solubles” (Boruff, 1952)



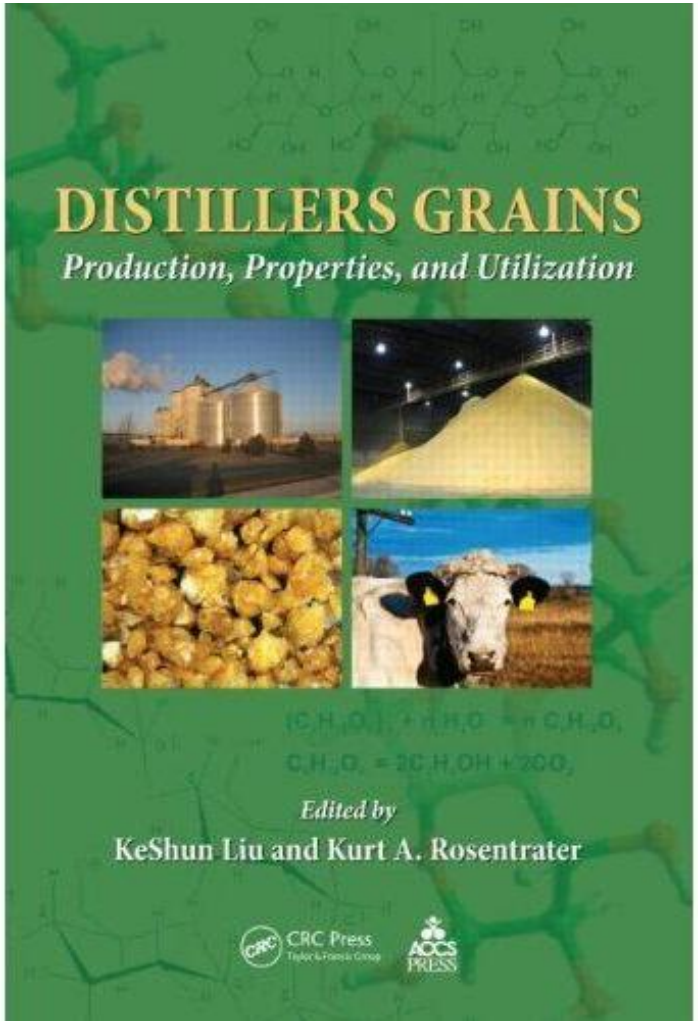
DDGS – Some Key Issues

2006

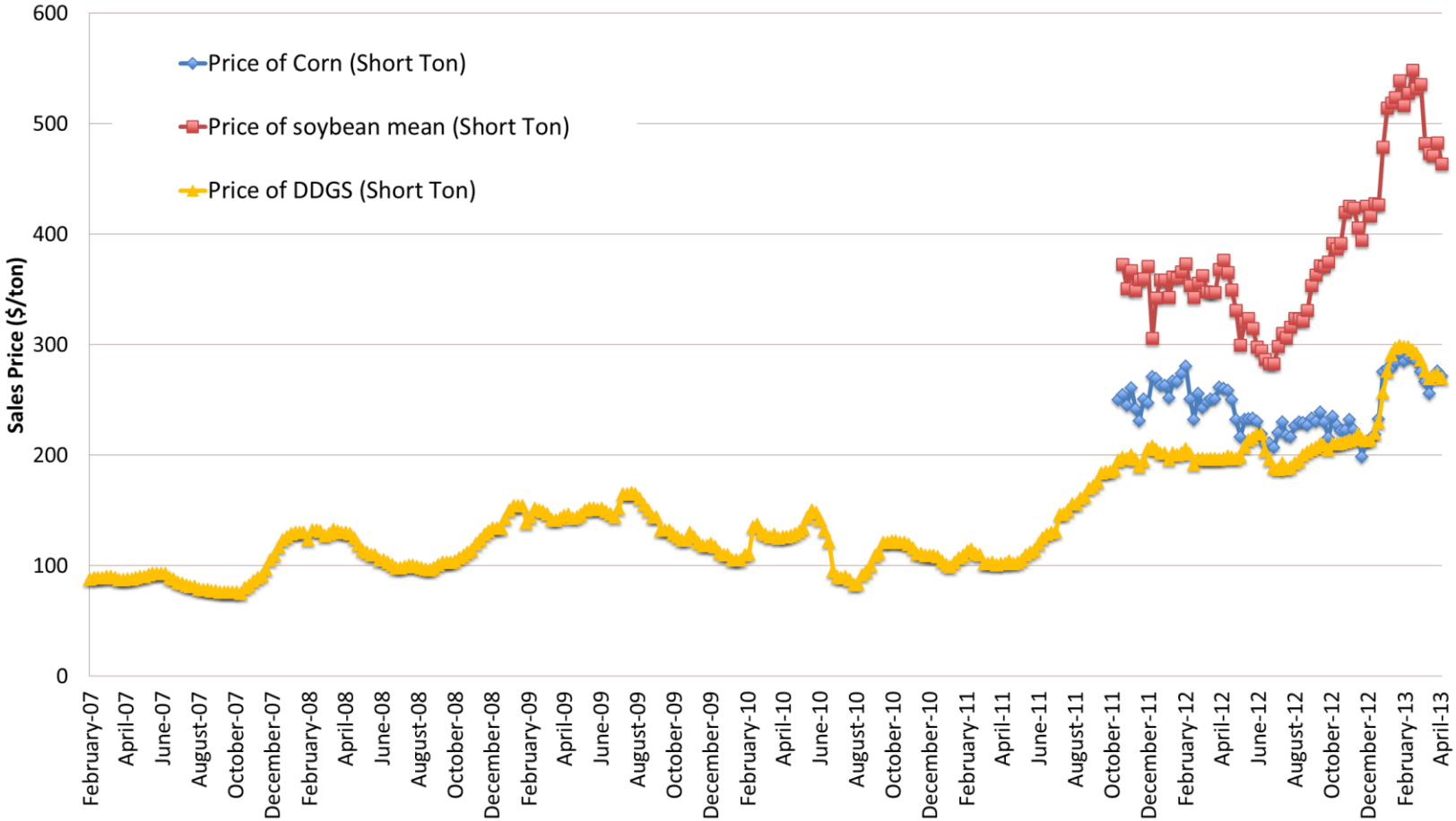
- "Mountains of distillers grains"
- Standardized grading system
- Livestock feed
  - Current generation products
  - Next generation products
  - Processed feeds
  - New species
- Antibiotic residues
- Sulfur / phosphorous
- Aflatoxin contamination
- Energy consumption / cost
- Optimizing quality w/ ethanol

- Consistency / variability
- Transportation
  - Domestic
  - International
  - Flowability
- Other value-added uses
  - Human foods
  - Industrial products

What do we know?

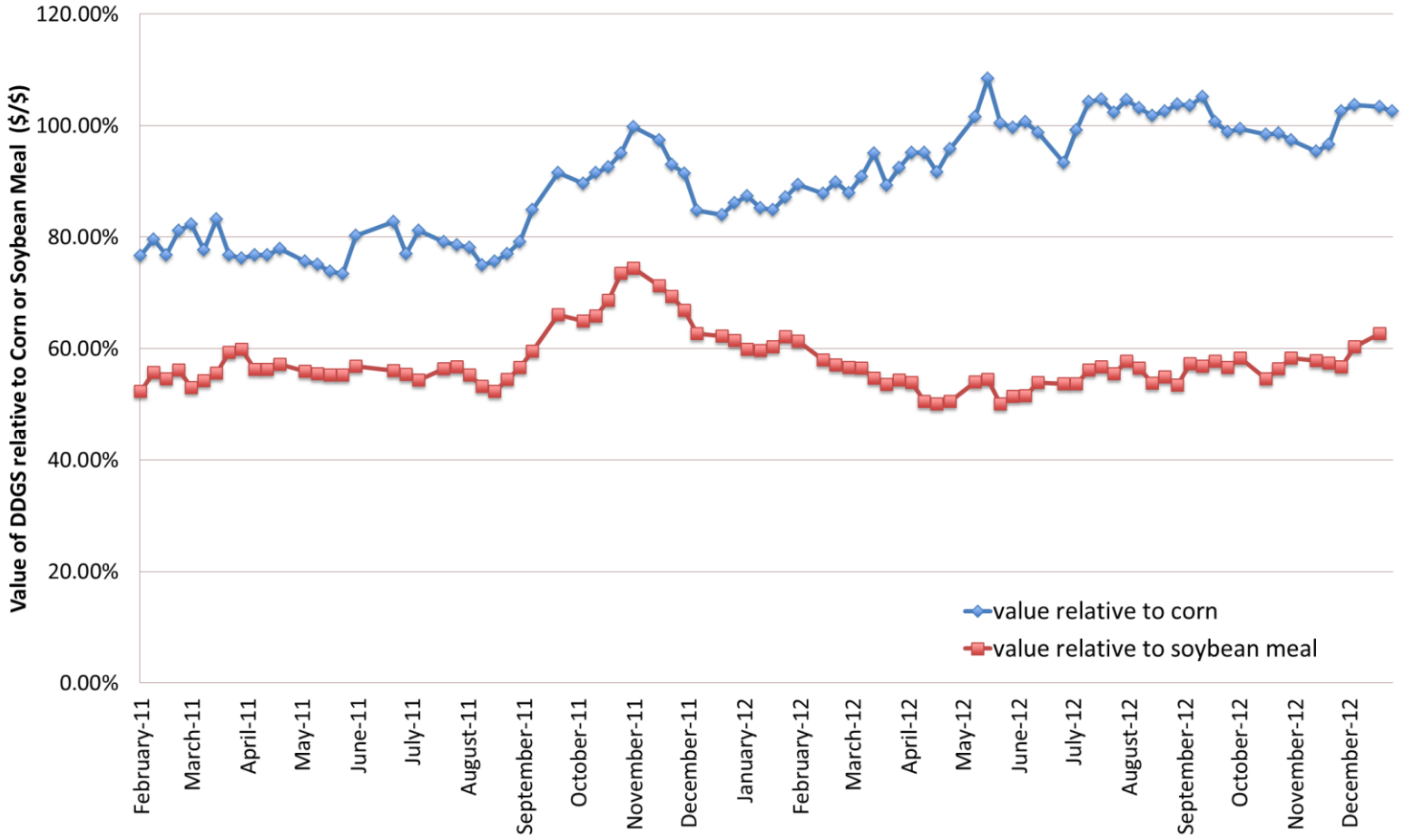


What do we know?



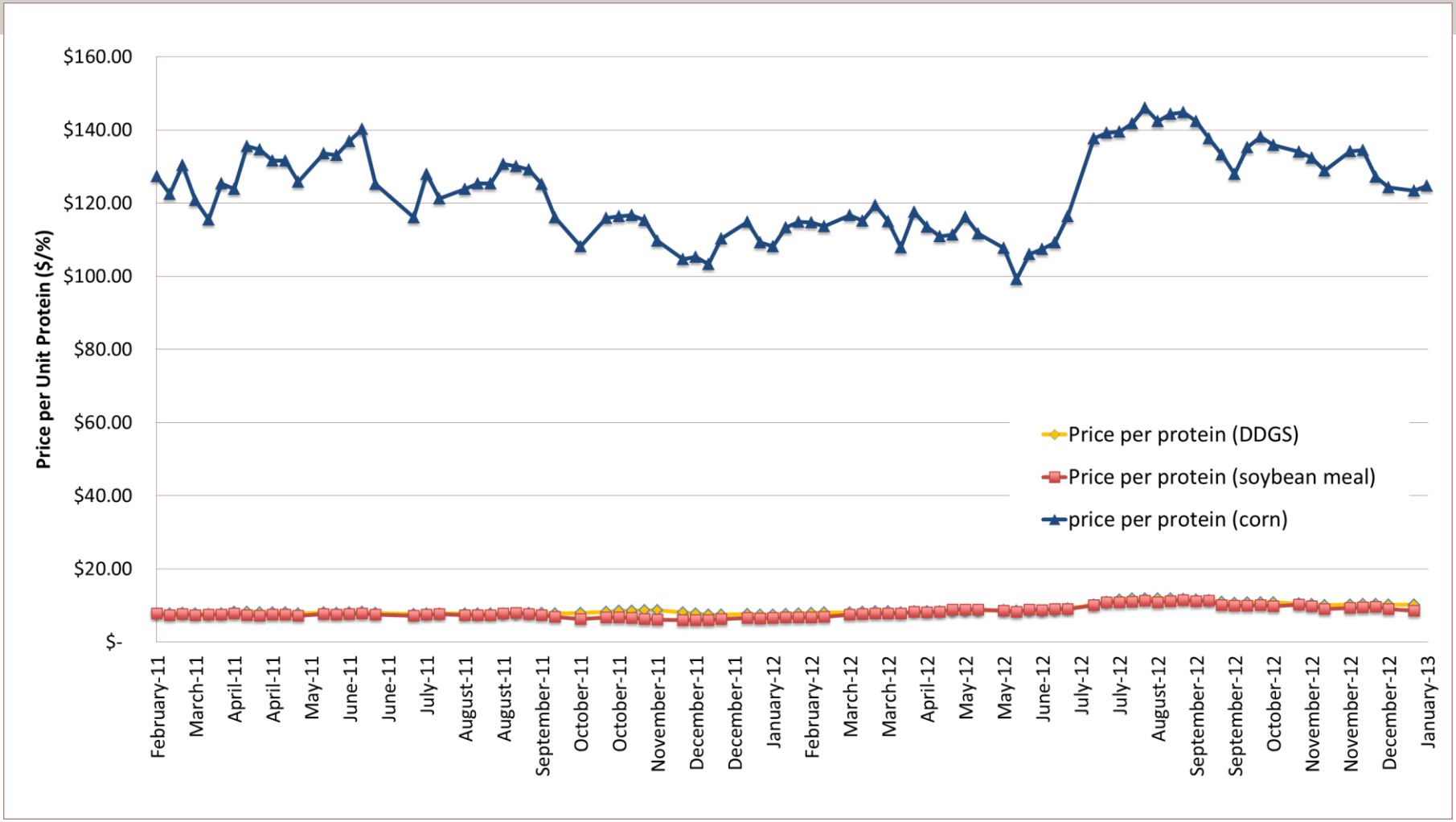
Based on data provided by Cheryl Anderson, DTN

What do we know?



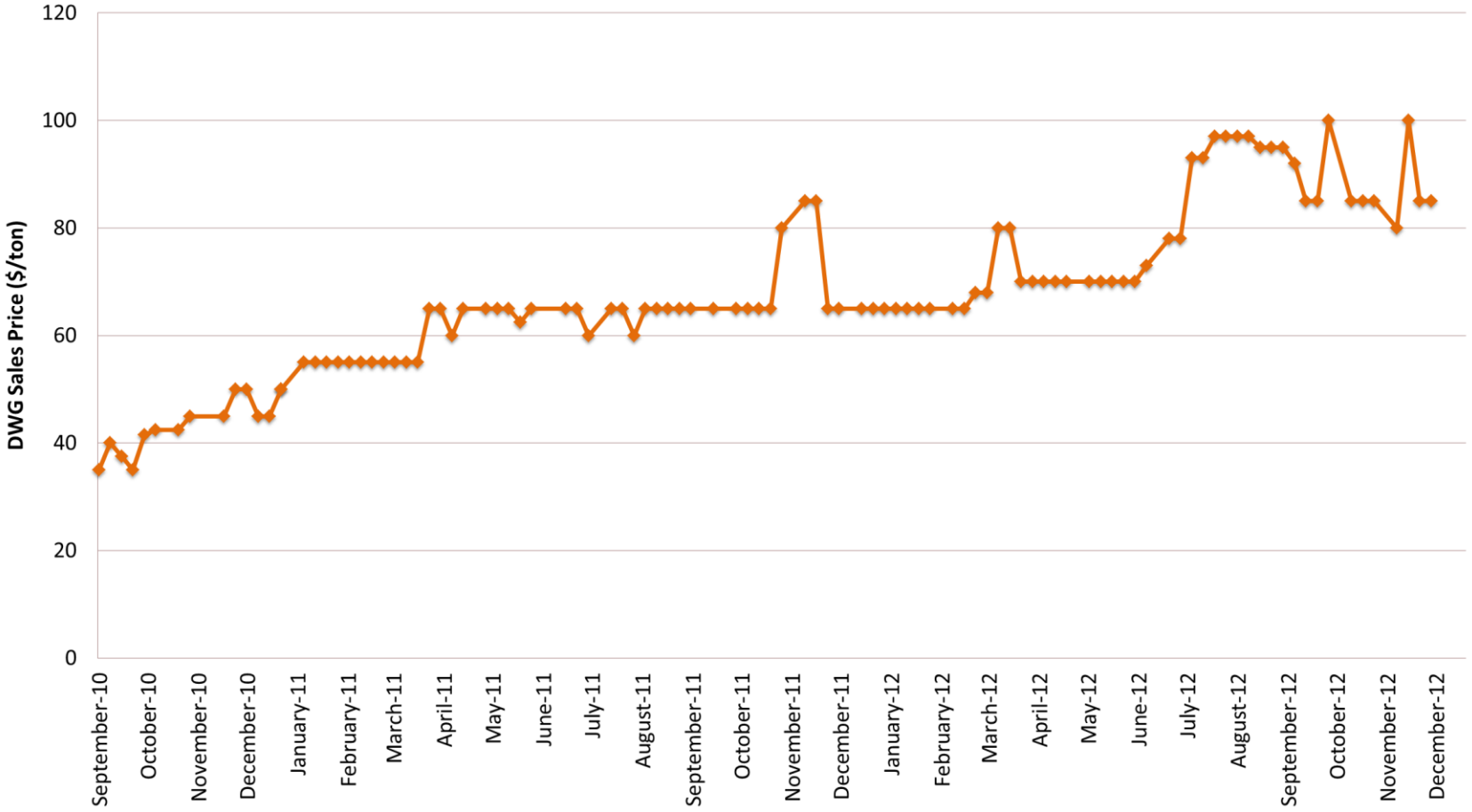
Based on data provided by Cheryl Anderson, DTN

What do we know?



Based on data provided by Cheryl Anderson, DTN

What do we know?



Based on data provided by Cheryl Anderson, DTN

What do we know?

- More than 40 million metric tons of distillers grains produced in 2013
  - Currently being fed domestically and exported (up to 25%)
- Animal feed
  - Beef and dairy; swine and poultry
  - Many feeding trials have been conducted
  - Inclusion levels have increased for all animal species as understanding has increased.
- Still unclear
  - How much each livestock sector actually consumes
  - How coproducts are specifically used at individual feeding operations

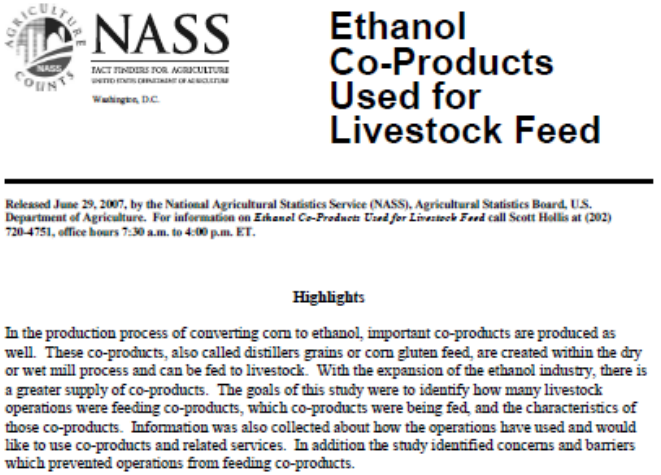
What don't we know?

- In other words,
  - We need to understand
    - Proportions in beef, dairy, swine, and poultry?
    - Which distillers coproducts are being used?
    - Coproduct dietary inclusion rates?
    - Which ingredients these coproducts substitute for?
    - Challenges associated with coproduct use?

Ethanol Co-Products Used for Livestock Feed
USDA NASS, 2007

- Surveyed feeders of cow/calf, fed cattle, dairy cattle, and swine, but not poultry in 2006
  - Mainly selected Midwest states
  - Lacked national scope
  - 9,400 livestock operations contacted by mail, with a second mailing two weeks later, and a telephone follow-up during the following month

- Minimum operation size: 20 head dairy cattle, 50 head cattle on feed, 10 head beef cattle, 25 head hogs



NASS
FACT FINDERS FOR AGRICULTURE
Washington, D.C.

Ethanol Co-Products Used for Livestock Feed

Released June 29, 2007, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, U.S. Department of Agriculture. For information on *Ethanol Co-Products Used for Livestock Feed* call Scott Hollis at (202) 720-4751, office hours 7:30 a.m. to 4:00 p.m. ET.

Highlights

In the production process of converting corn to ethanol, important co-products are produced as well. These co-products, also called distillers grains or corn gluten feed, are created within the dry or wet mill process and can be fed to livestock. With the expansion of the ethanol industry, there is a greater supply of co-products. The goals of this study were to identify how many livestock operations were feeding co-products, which co-products were being fed, and the characteristics of those co-products. Information was also collected about how the operations have used and would like to use co-products and related services. In addition the study identified concerns and barriers which prevented operations from feeding co-products.

Ethanol Co-Products Used for Livestock Feed
USDA NASS, 2007

- Coproducts surveyed:
  - Condensed Distillers Grains (CDS)
  - Distillers Dried Grains, No Solubles (DDG)
  - Distillers Dried Grains with Solubles (DDGS)
  - Corn Gluten Feed
  - Brewers Grains
  - Distillers Wet Grains (25-40%, and over 40%)
  - Complete Commercial Feed
  - Coproducts from New Processes
  - Combinations of Coproducts
  - Other Coproducts
- Of 9,400 operations contacted, 1,276 indicated that they used coproducts during 2006

13.5% response rate

Ethanol Co-Products Used for Livestock Feed
USDA NASS, 2007

- Beef cattle (cow/calf)
  - Fed DDGS at 22% inclusion rate
- Cattle on feed
  - Fed DDGS at 23% inclusion rate
- Dairy
  - Fed DGGS at 8% inclusion rate
- Hogs
  - Fed DDGS at 10% inclusion rate

Ethanol Co-Products Used for Livestock Feed
USDA NASS, 2007

- Higher percentage of cow/calf operations, dairy, and cattle on feed were fed co-products than swine operations

- Most co-products were purchased through the ethanol plant or feed companies/co-ops

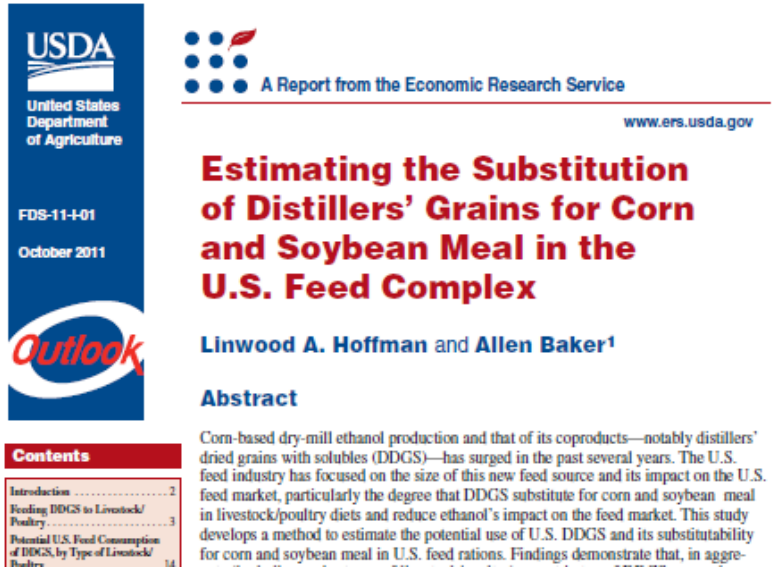
- Co-products most used
  - Distillers Dried Grains, No Solubles (DDG)
  - Distillers Dried Grains with Solubles (DDGS)
  - Corn Gluten Feed (CGF)

Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex

Hoffman & Baker, USDA, ERS, 2012

- Purpose: estimate substitution potential of DDGS for corn (energy) and soybean meal (protein), and the impact this has upon the U.S. livestock industry

- Examined:
  - Feeding characteristics of DDGS
  - Inclusion rates for livestock/poultry
  - Substitution rates for DDGS for corn and soybean meal
  - DDGS consumption estimates by crop year
  - DDGS exports
  - Impacts on the U.S. feed industry



USDA
United States Department of Agriculture
FDS-11-I-01
October 2011
Outlook

Contents

Introduction 2
Feeding DDGS to Livestock/Poultry 3
Potential U.S. Feed Consumption of DDGS, by Type of Livestock/Poultry 14

A Report from the Economic Research Service
www.ers.usda.gov

Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex

Linwood A. Hoffman and Allen Baker[1]

Abstract

Corn-based dry-mill ethanol production and that of its coproducts—notably distillers' dried grains with solubles (DDGS)—has surged in the past several years. The U.S. feed industry has focused on the size of this new feed source and its impact on the U.S. feed market, particularly the degree that DDGS substitute for corn and soybean meal in livestock/poultry diets and reduce ethanol's impact on the feed market. This study develops a method to estimate the potential use of U.S. DDGS and its substitutability for corn and soybean meal in U.S. feed rations. Findings demonstrate that, in aggre-

Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex

Hoffman & Baker, USDA, ERS, 2012

- Beef Cattle of feed:
  - Maximum potential inclusion rate: 20-40%
  - NASS 2007: 22%
- Dairy Cows:
  - Maximum potential inclusion rate: 10-30%
  - NASS 2007: 8%
- Market Swine:
  - Maximum potential inclusion rate: 10-30%,
  - NASS 2007: 10%
- Poultry (Layers, Broilers, Turkeys):
  - Maximum potential inclusion rate: 10-15%
  - NASS 2007: N/A

Table 8

Estimates of potential annual DDGS consumption, by selected crop year and type of livestock/poultry

Type of live-stock/poultry	Crop year										Average of all estimates	
	2006/07		2007/08		2008/09		2009/10		2010/11			
	1,000 metric tons	*Percent*	*1,000 metric tons*	*Percent*	*1,000 metric tons*	*Percent*	*1,000 metric tons*	*Percent*	*1,000 metric tons*	*Percent*	*1,000 metric tons*	*Percent*
Beef	31,178	50.1	31,273	49.5	29,831	48.3	29,484	48.5	29,736	48.7	30,301	49.0
Cows	4,735	7.6	4,705	7.4	4,600	7.4	4,550	7.5	4,477	7.3	4,613	7.5
Replacement heifers	1,235	2.0	1,194	1.9	1,170	1.9	1,156	1.9	1,092	1.8	1,170	1.9
Cattle on feed	20,633	33.2	20,886	33.1	19,519	31.6	19,217	31.6	19,754	32.3	20,002	32.4
Other cattle	4,576	7.4	4,488	7.1	4,542	7.3	4,560	7.5	4,413	7.2	4,516	7.3
Dairy	16,154	26.0	16,362	25.9	16,487	26.7	16,100	26.5	16,216	26.5	16,264	26.3
Cows	15,218	24.5	15,404	24.4	15,531	25.1	15,119	24.9	15,226	24.9	15,300	24.8
Replacement heifers	937	1.5	958	1.5	956	1.5	980	1.6	990	1.6	964	1.6
Hogs	7,781	12.5	8,439	13.4	8,604	13.9	8,344	13.7	8,324	13.6	8,298	13.4
Breeding swine	1,359	2.2	1,373	2.2	1,334	2.2	1,294	2.1	1,281	2.1	1,328	2.1
Market swine	6,421	10.3	7,067	11.2	7,269	11.8	7,050	11.6	7,043	11.5	6,970	11.3
Poultry	7,063	11.4	7,109	11.3	6,898	11.2	6,820	11.2	6,831	11.2	6,944	11.2
Layers	1,479	2.4	1,456	2.3	1,438	2.3	1,446	2.4	1,445	2.4	1,453	2.4
Pullets	287	0.5	295	0.5	290	0.5	295	0.5	299	0.5	293	0.5
Broilers	4,284	6.9	4,323	6.8	4,192	6.8	4,143	6.8	4,155	6.8	4,220	6.8
Turkeys	1,013	1.6	1,035	1.6	977	1.6	937	1.5	933	1.5	979	1.6
Total	62,177	100.0	63,184	100.0	61,819	100.0	60,748	100.0	61,107	100.0	61,807	100.0

Note: Totals may not add due to rounding.

Sources: USDA, Economic Research Service calculations based on data from tables 3, 4, 5, 6, and 7.

Estimating the Substitution of Distillers' Grains for Corn and Soybean Meal in the U.S. Feed Complex

Hoffman & Baker, USDA, ERS, 2012

- 1 tonne of DDGS can replace 1.22 tonnes of corn/soybean meal
- Estimates may not match current feeding levels as prices change
- Potential consumption rates are based on the price of DDGS not being a barrier to use

What don't we know?

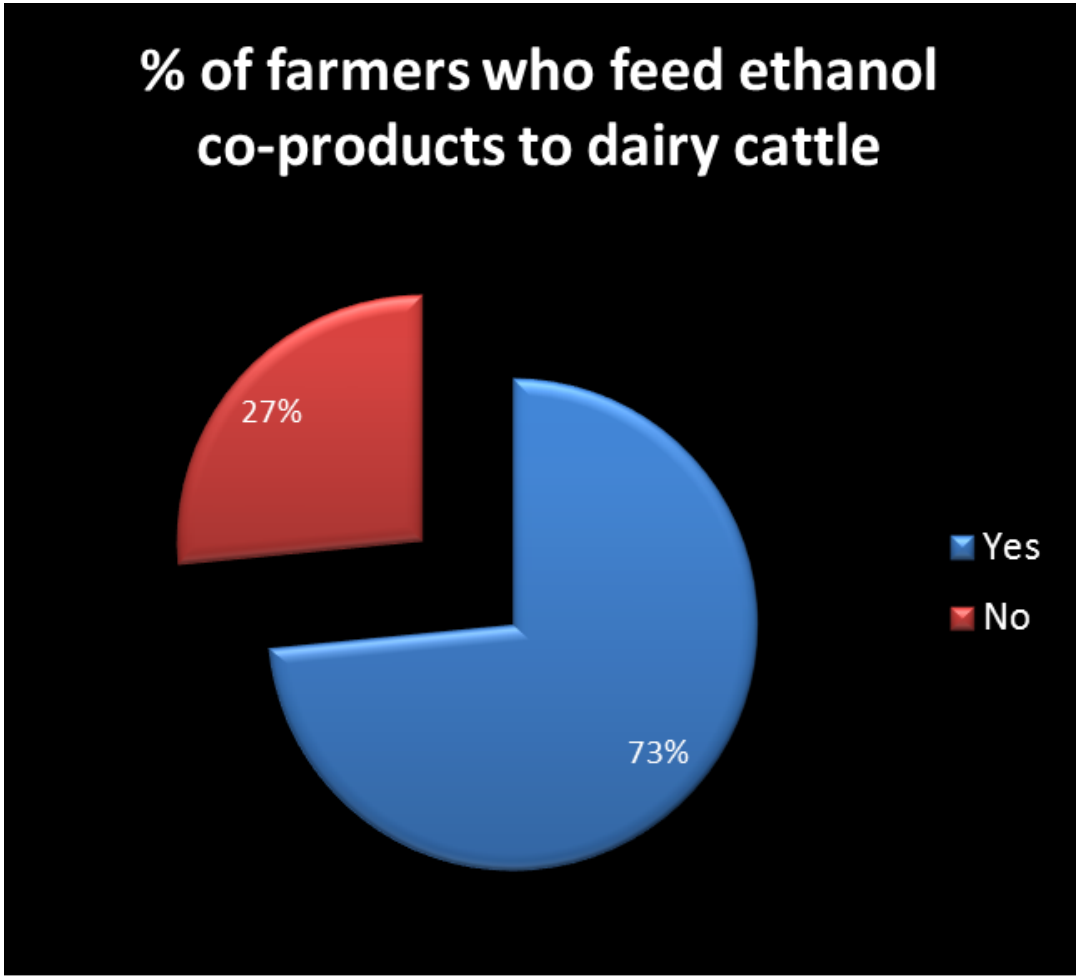
- Still need current, specific information
  - 2006 survey data is dated
    - Ethanol & livestock industries have been dynamic
  - Modeling study
    - Based on literature review & estimates, not specific data

Pilot Study – SD Dairy Farms

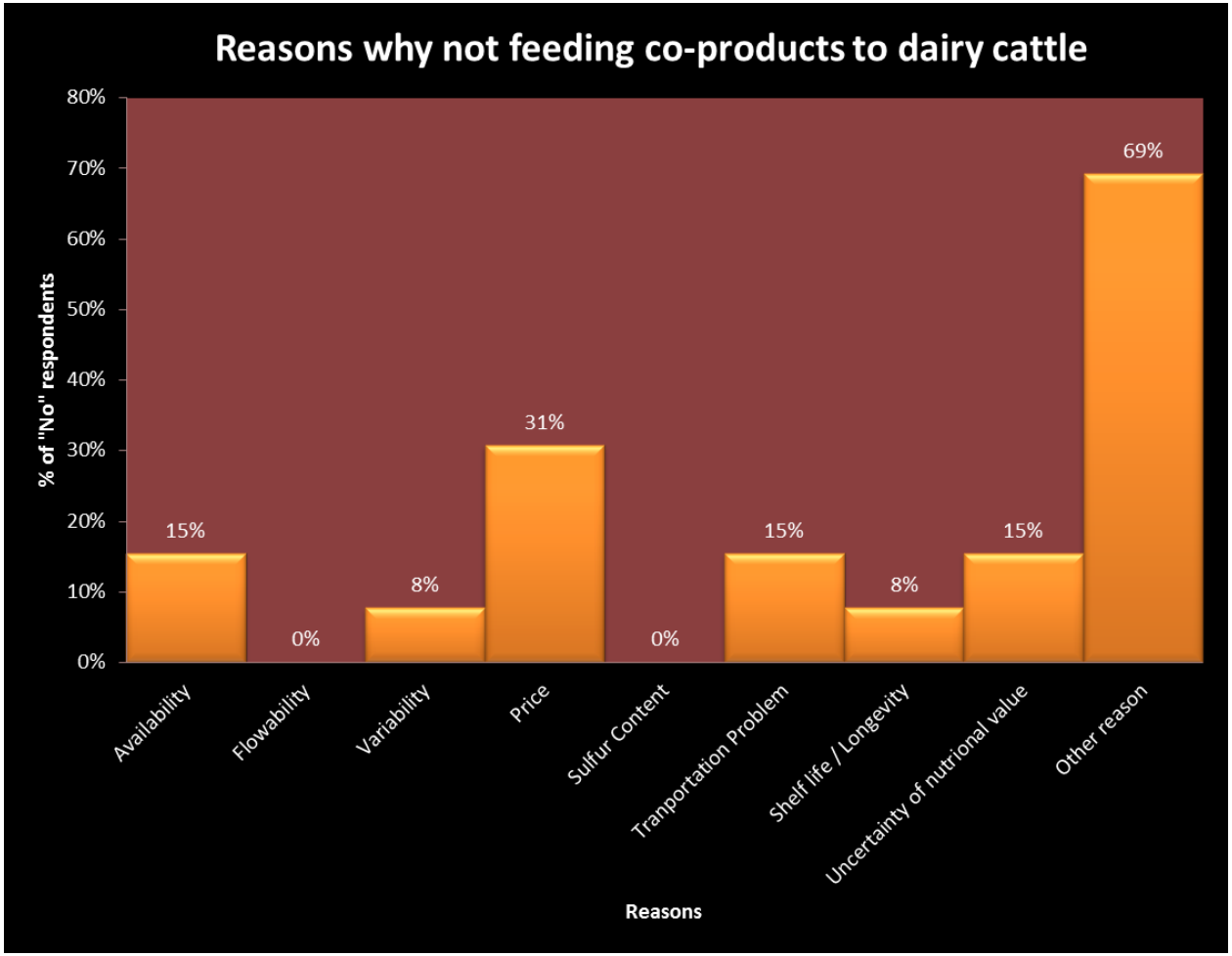
- 2011/2012
  - 358 total dairy farms operating in SD
  - Surveys were mailed to all Grade A facilities (303)
  - 15 questions, < 20 minutes
  - No identifiable information
  - All responses were kept confidential

- Response rate: 16.17% (49 of 303 completed surveys)

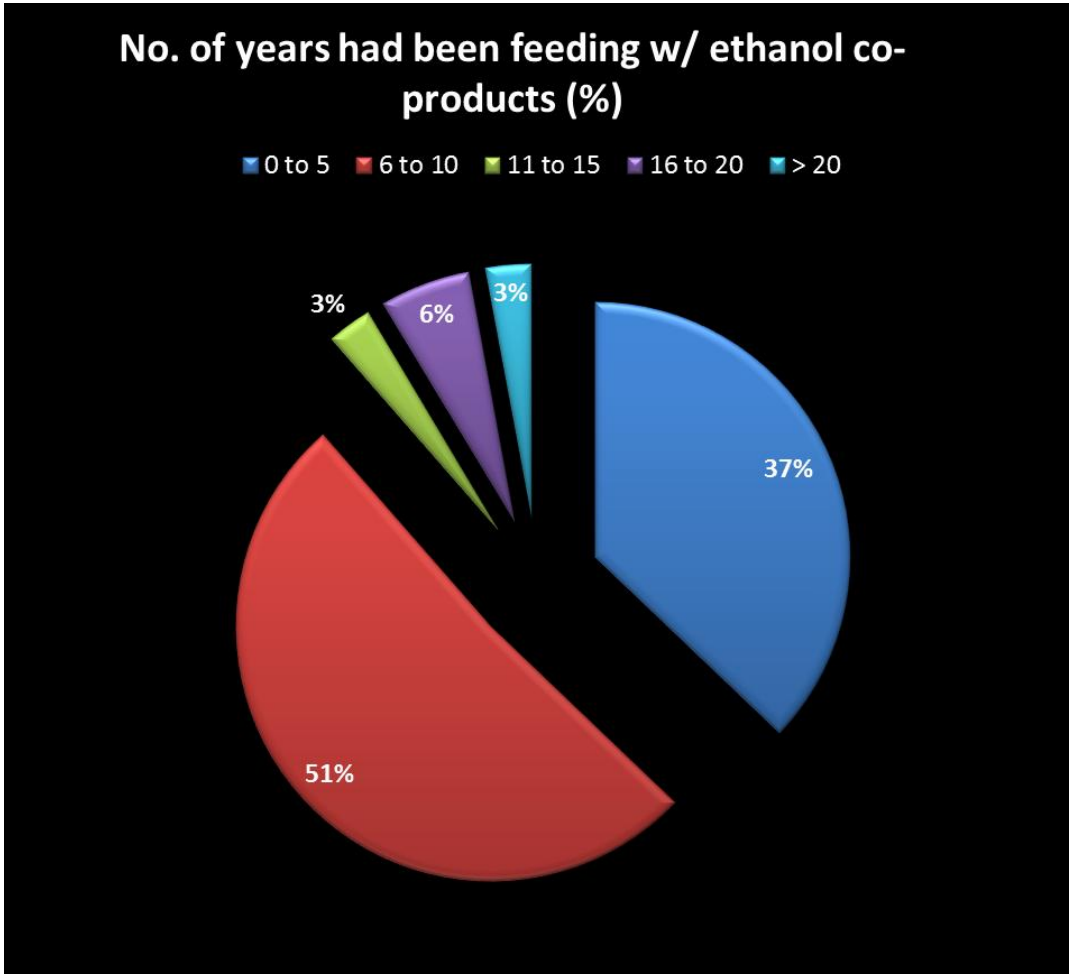
1 – Did you feed ethanol co-products to your dairy cattle?



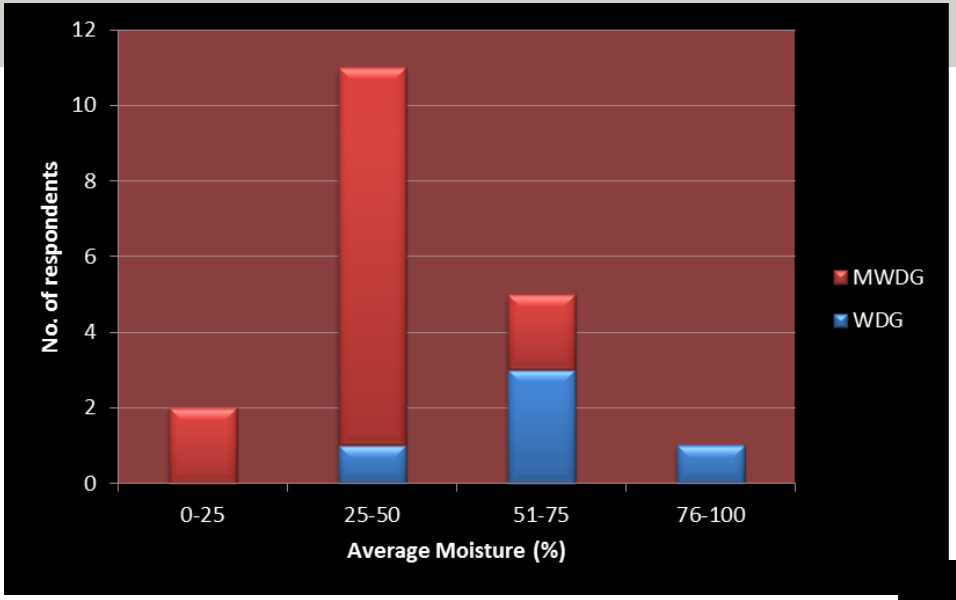
2 – What is the primary reason for not feeding ethanol co-products to your dairy

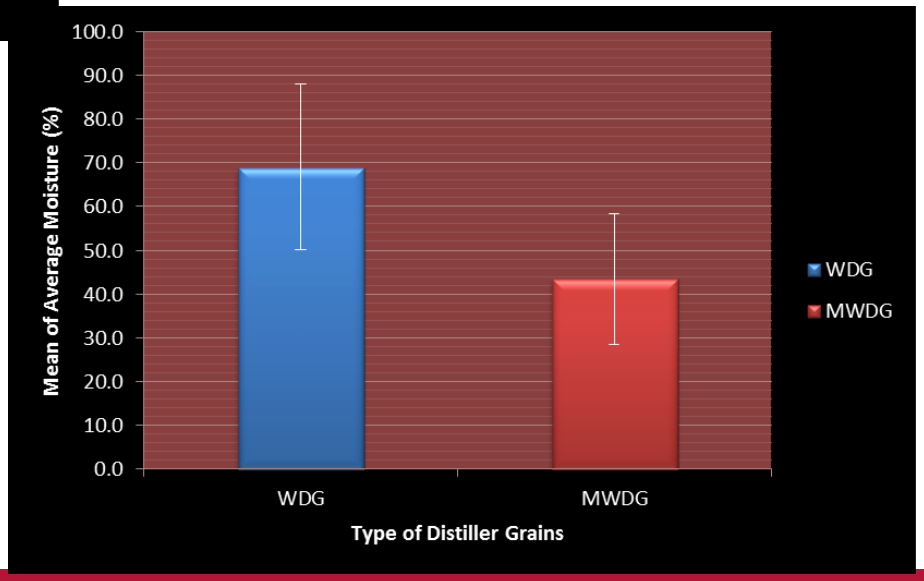


2 – Number of years have you been feeding co-products?

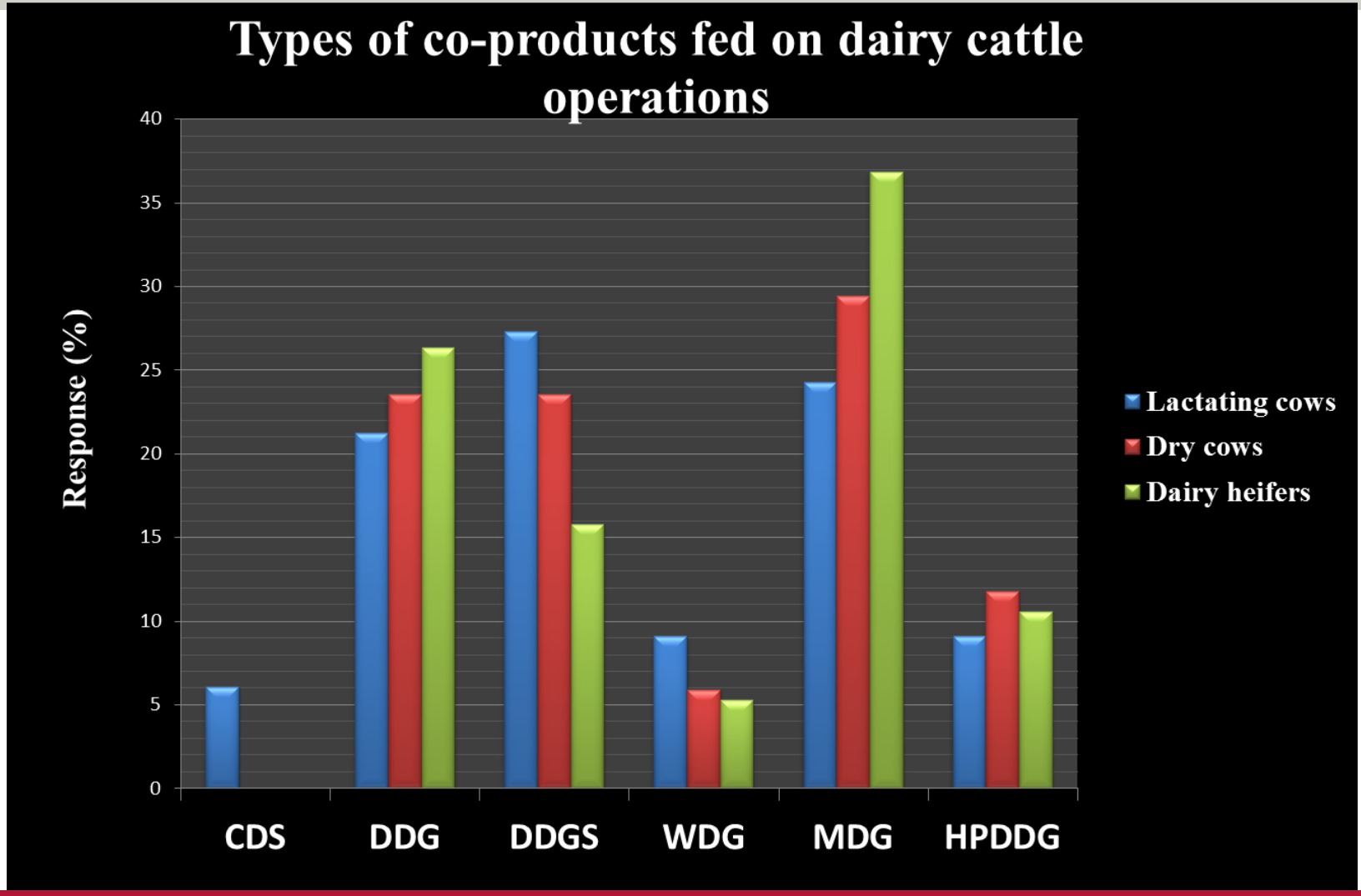


3 – What was the average moisture content?

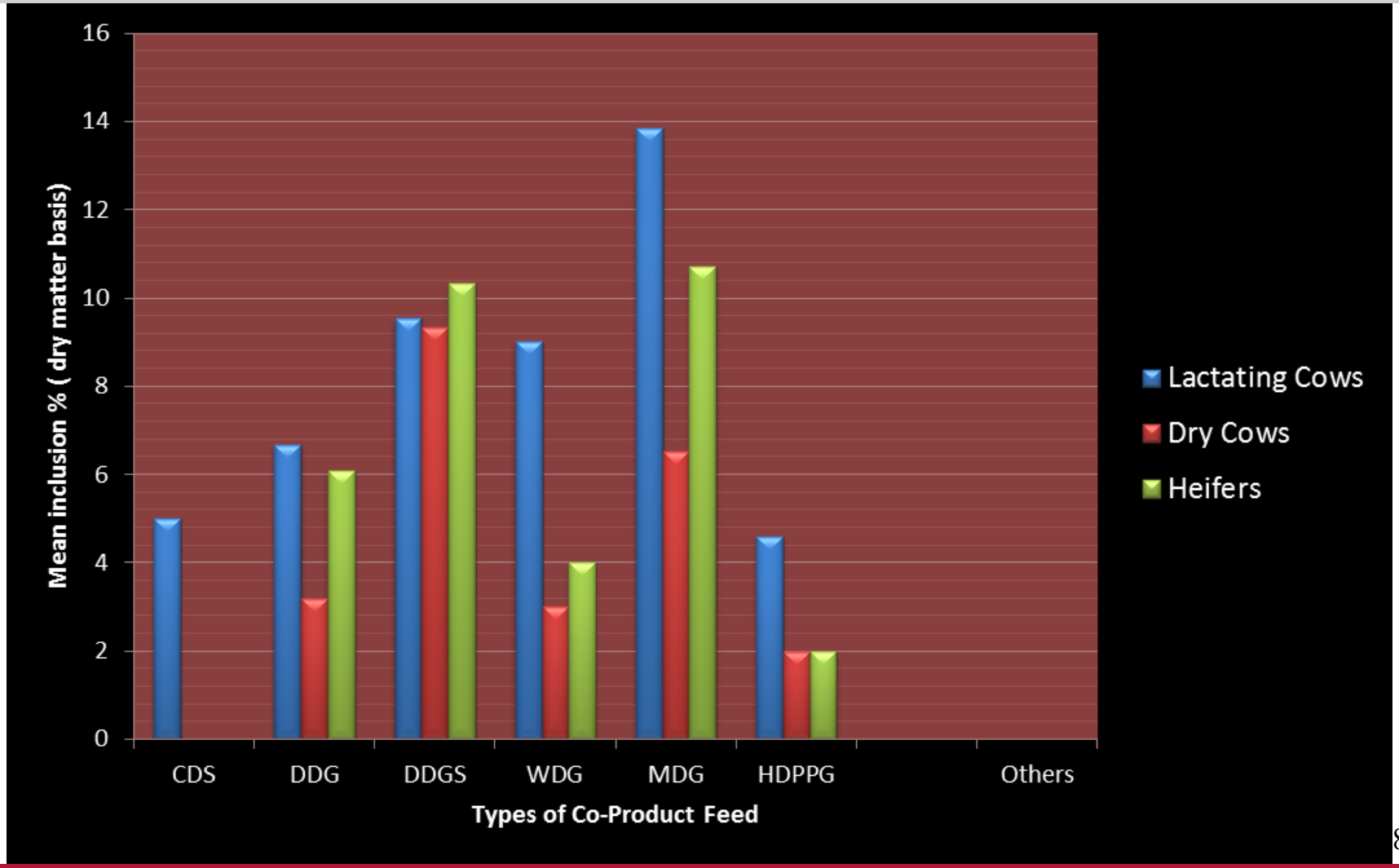




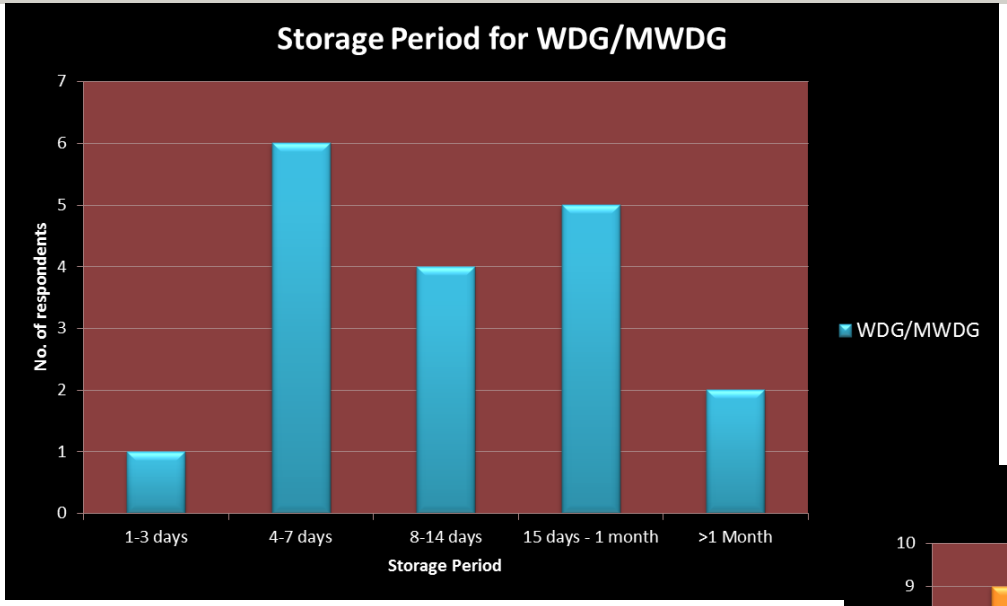
4 – What was fed and how much?

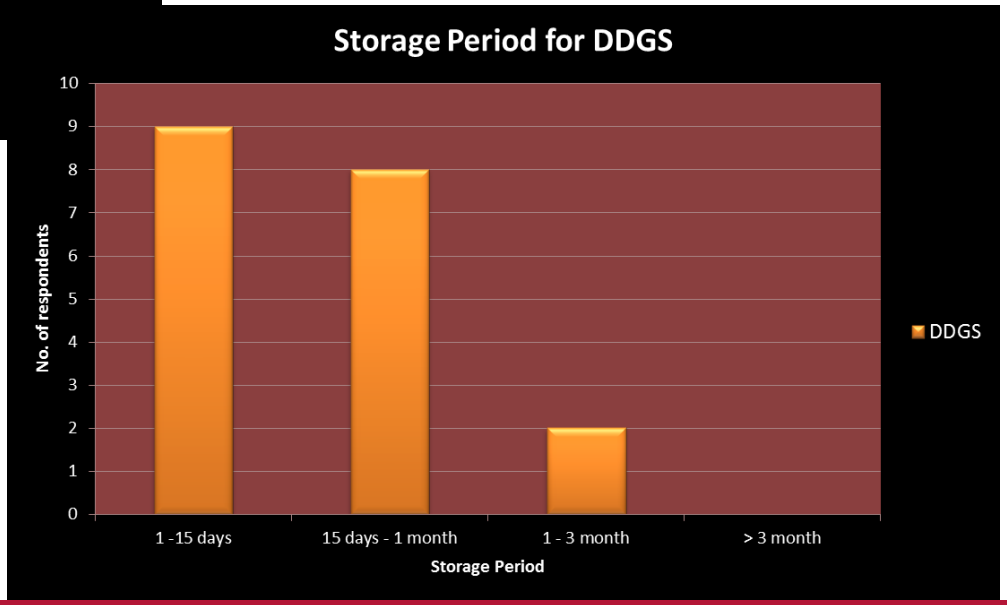


4 – What was fed and how much?

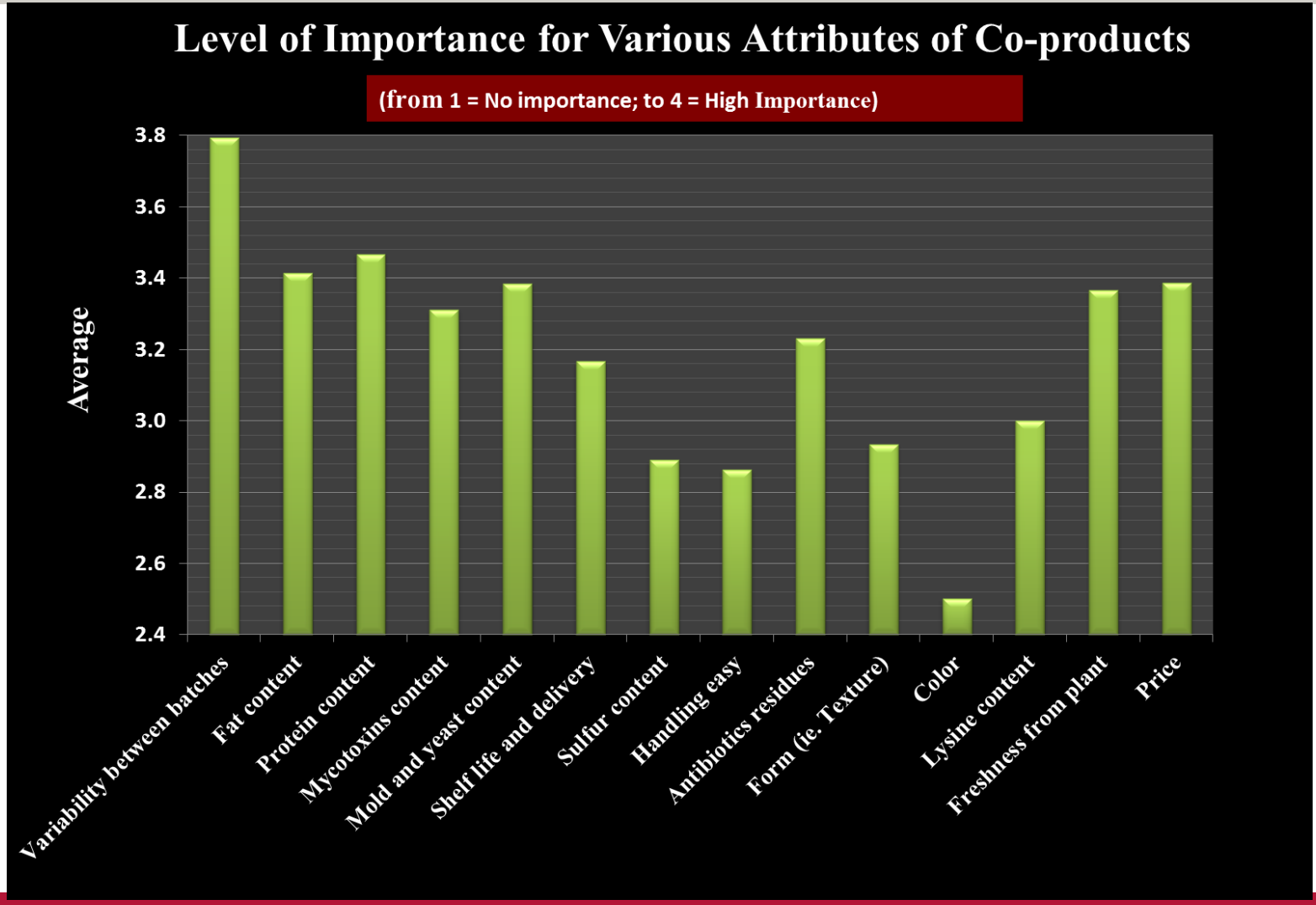


5 – How long are the co-products stored in the farm before use?

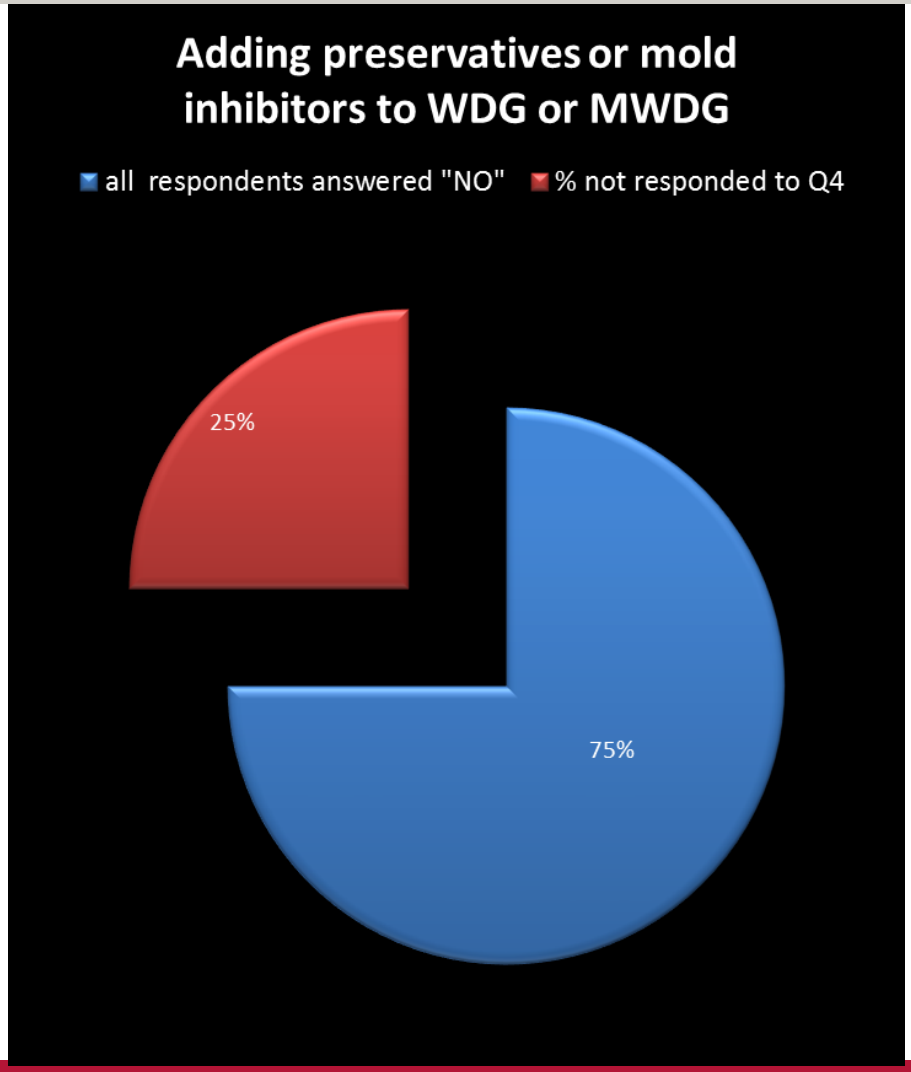




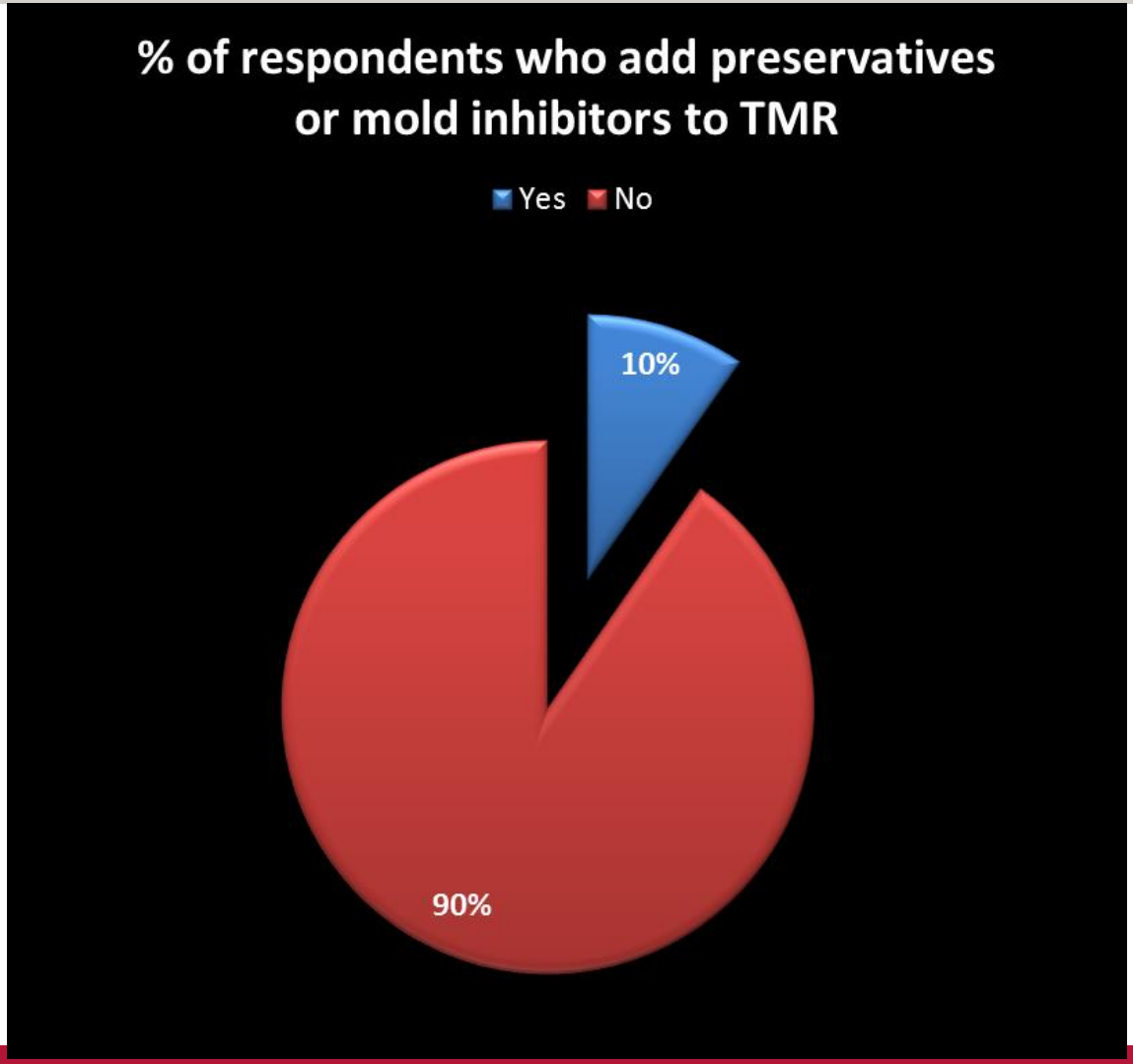
6 – What is the level of importance of the various co-product characteristics?



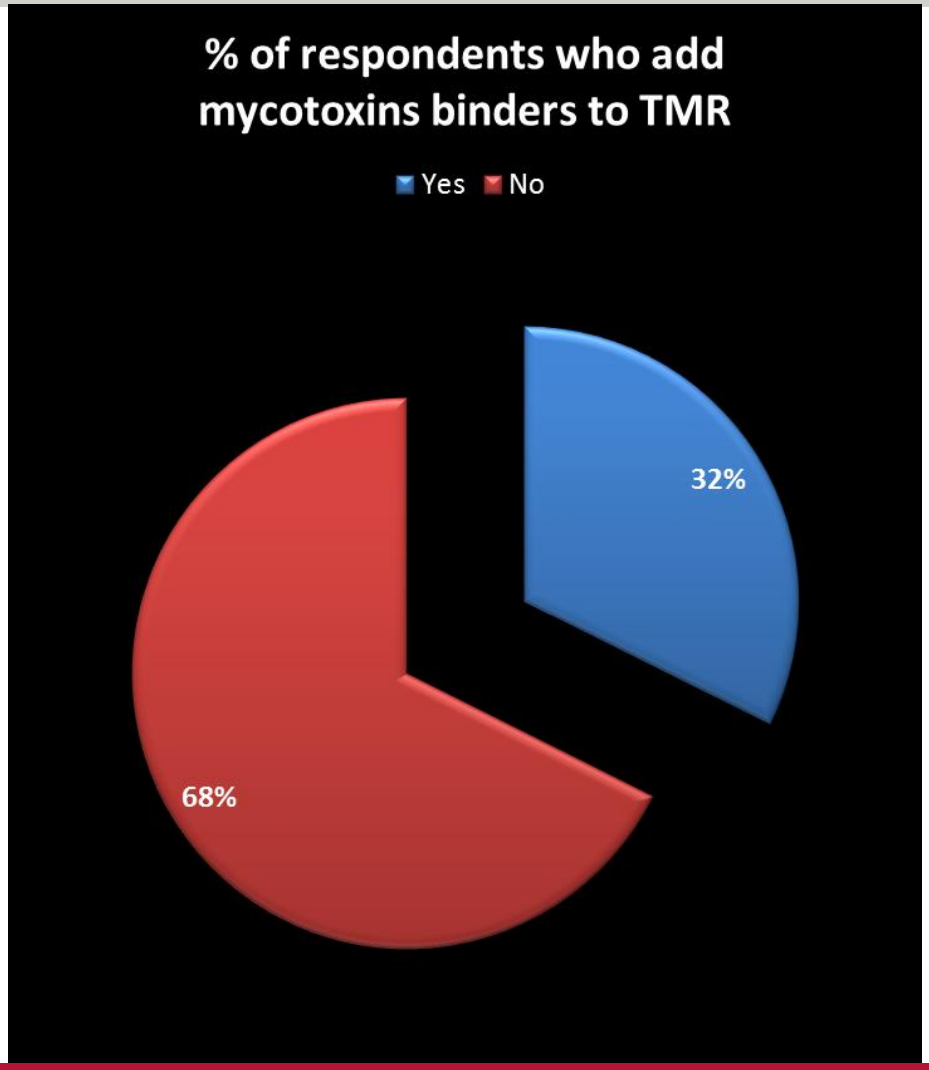
7 – Are you adding any preservatives or mold inhibitors?



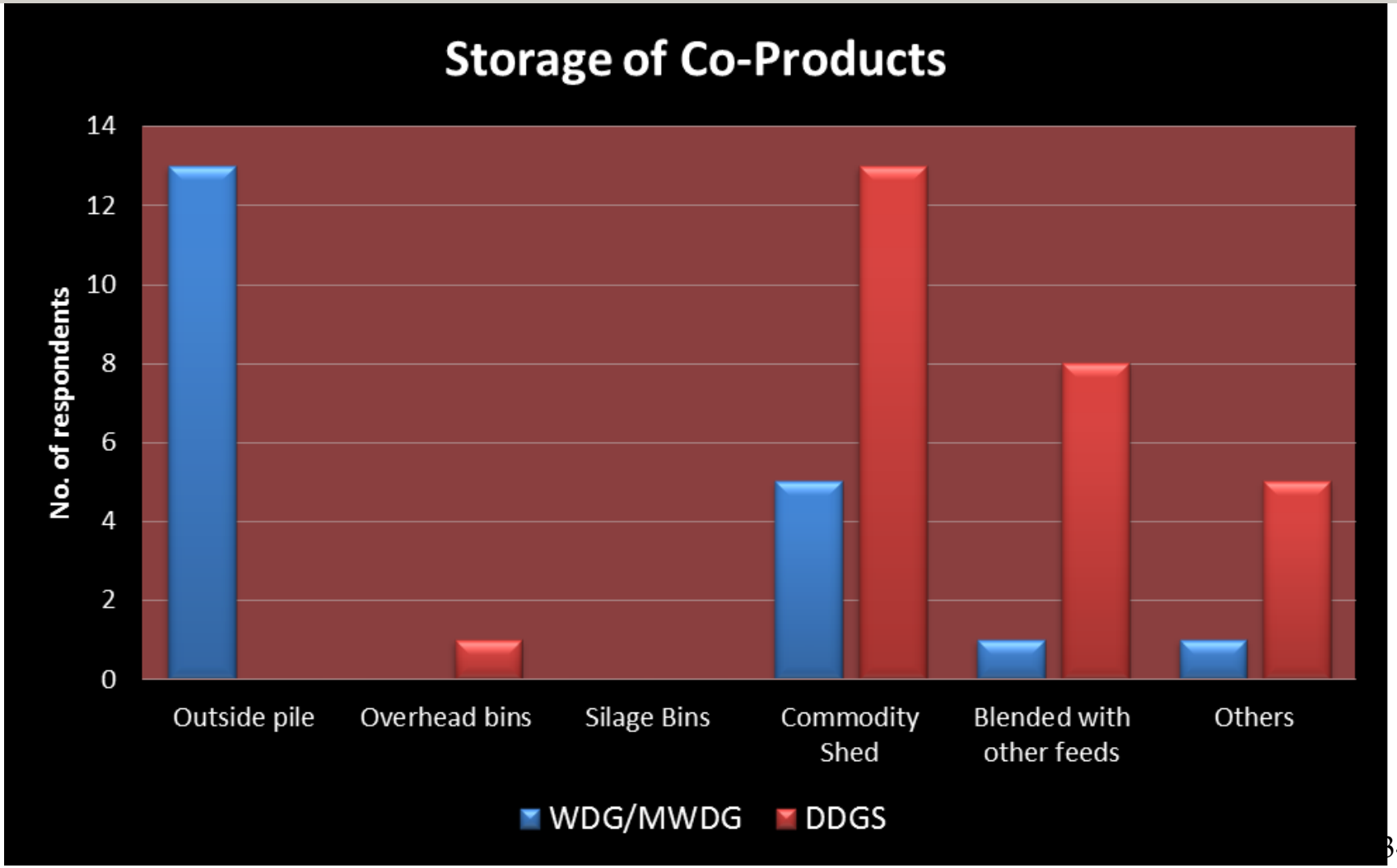
7 – Are you adding any preservatives or mold inhibitors?



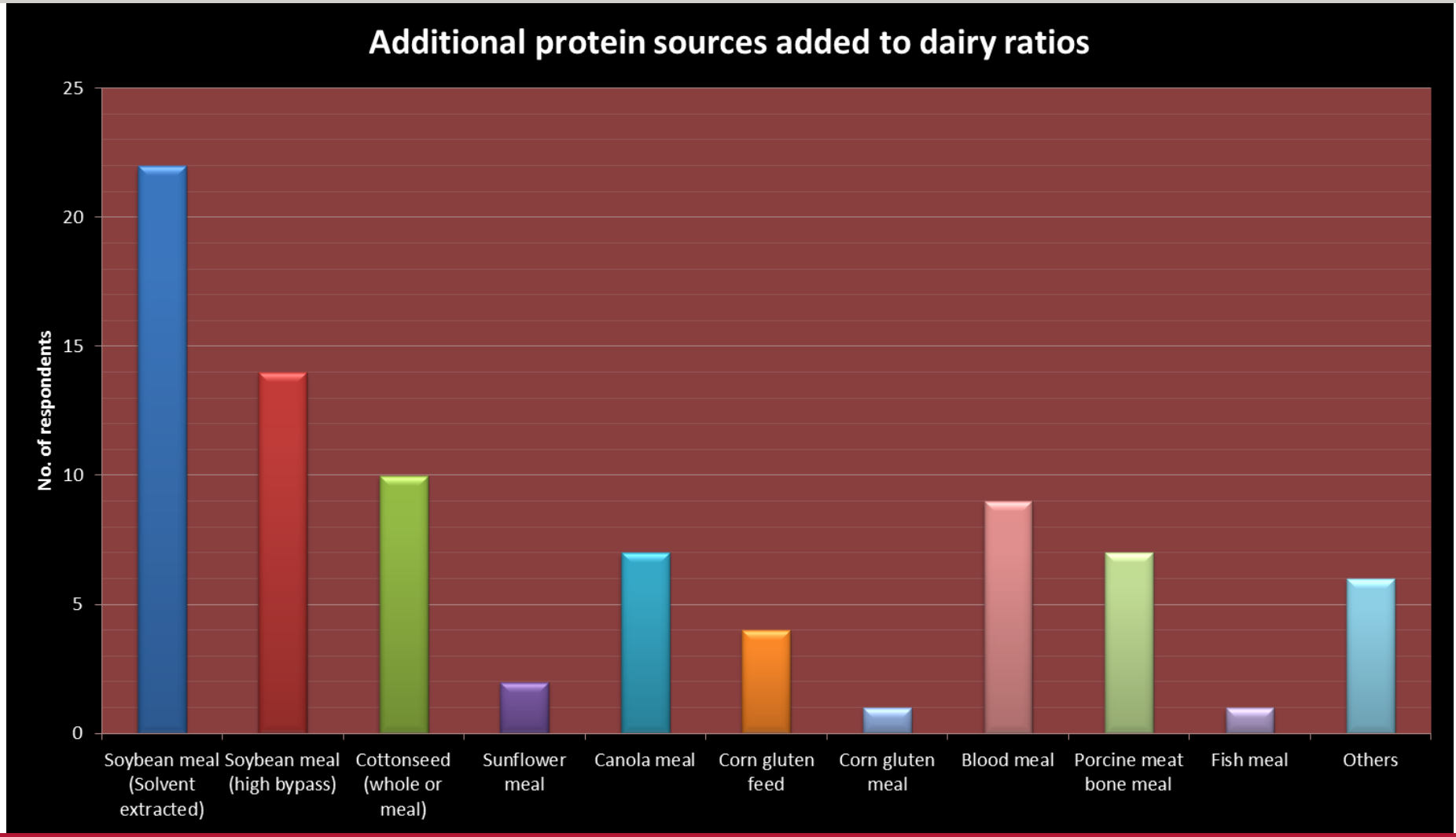
8 – Are you adding any mycotoxins binders?



9 – Where do you store the co-products in your farm?



10 – Additional protein sources added to your dairy rations?



Pilot Study – Open Responses

- Consistency.
- It works well for us.
- Would like to see a little less moisture.
- Feed price is getting very high.
- Only use small amount of DDGS. Does not work in dairy rations at higher levels.
- Price is too high.
- Will stop feeding ASAP as it is not very cost effective!
- Competing with ethanol plant for corn is very difficult for dairy farmers.
- We feed wet corn gluten instead.
- We remain HUGE supporters of the ethanol industry in South Dakota.
- Can only feed a small amount to dairy cows.
- Fed it in the past, too much variability/wary of mycotoxins.
- We are not set-up to handle by-products. Too small of a dairy & too old.
- Don't use due to moldy corn in area being used in processing plant.
- Lost too many animals to Clostridia A in 2004. Stopped the use of distillers and stopped losing animals.

Pilot Study – Summary

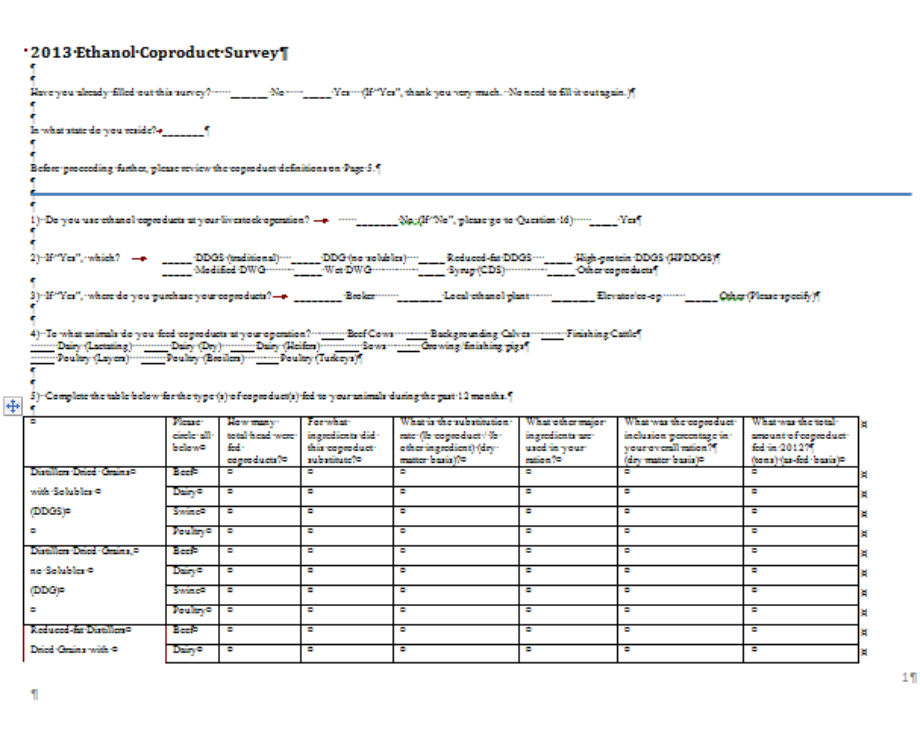
- South Dakota dairy producers surveyed that were using ethanol co-products during 2010/2011: **73%**
- These producers had been using ethanol co-products, on average, for **8** years (S.D. = 4.6).
- **Price** was the main reason for not feeding ethanol co-products.
- DDGS was the co-product most frequently fed to lactating dairy cows (27.7%).
- Modified DG were mostly used in dry cows and dairy heifer rations (29.4 and 36.8%, respectively).
- **Outside pile** was the most common storage method for wet or modified DG, while **commodity sheds** was for DDGS
- **Soybean meal** (solvent extracted) was the protein source most frequently used in rations that contained ethanol co-products.
- "**Variability** between batches" was the issue with the highest degree of importance.

1 – Next Steps

- 2013 U.S. livestock & poultry survey
  - Beef
  - Dairy
  - Swine
  - Poultry
- 2-stage survey
  - Online
    - Open until June 19
      http://humansciences.ethanolcoproducts.sgizmo.com/s3/
  - Mailed survey June 20 – August 20

1 – Next Steps

- 17 questions



2013 Ethanol Coproduct Survey

Have you already filled out this survey? _____ No _____ Yes (If "Yes", thank you very much. No need to fill it out again.)

In what state do you reside? _____

Before proceeding further, please review the coproduct definitions on Page 3.

1) Do you use ethanol coproducts at your livestock operation? _____ No (If "No", please go to Question 16) _____ Yes

2) If "Yes", which? _____ DDGS (traditional) _____ DDG (no solubles) _____ Reduced-fat DDGS _____ High-protein DDGS (HPDDGS)
_____ Modified DWG _____ Wet DWG _____ Syrup (CDS) _____ Other coproducts

3) If "Yes", where do you purchase your coproducts? _____ Broker _____ Local ethanol plant _____ Elevator/co-op _____ Other (Please specify)

4) To what animals do you feed coproducts at your operation? _____ Beef Cows _____ Backgrounding Calves _____ Finishing Cattle
_____ Dairy (Lactating) _____ Dairy (Dry) _____ Dairy (Heifers) _____ Sows _____ Growing/finishing pigs
_____ Poultry (Layers) _____ Poultry (Broilers) _____ Poultry (Turkeys)

5) Complete the table below for the type (s) of coproduct(s) fed to your animals during the past 12 months.

	Please circle all below	How many total head were fed coproducts?	For what ingredients did this coproduct substitute?	What is the substitution rate (lb coproduct / lb other ingredient) (dry matter basis)?	What other major ingredients are used in your ration?	What was the coproduct inclusion percentage in your overall ration? (dry matter basis)	What was the total amount of coproduct fed in 2012? (tons) (as-fed basis)
Distillers Dried Grains with Solubles (DDGS)	Beef						
	Dairy						
	Swine						
	Poultry						
Distillers Dried Grains, no Solubles (DDG)	Beef						
	Dairy						
	Swine						
	Poultry						
Reduced-fat Distillers Dried Grains with Solubles (DDGS)	Beef						
	Dairy						
	Swine						
	Poultry						
High Protein Distillers Dried Grains (HPDDGS)	Beef						
	Dairy						
	Swine						
	Poultry						
Modified Distillers Wet Grains (MDWG)	Beef						
	Dairy						
	Swine						
[Moisture content:]	Poultry						
Distillers Wet Grains (DWG)	Beef						
	Dairy						
	Swine						
[Moisture content:]	Poultry						
Condensed Distillers Solubles (CDS, syrup)	Beef						
	Dairy						
	Swine						
[Moisture content:]	Poultry						
Other coproducts (specify) _____	Beef						
	Dairy						
	Swine						
	Poultry						

6) How did your animals perform on these coproducts (please circle)? Better Slight Improvement About the Same Slightly Worse Worse
Please explain.

7) Why do you feed these coproducts (please circle all that apply)? Price is Lower Animal Performance is Better Better Availability Other (please specify)

8) What would cause you to use more coproducts (please circle all that apply)? Price is Lower Animal Performance is Better Better Availability Other (please specify)

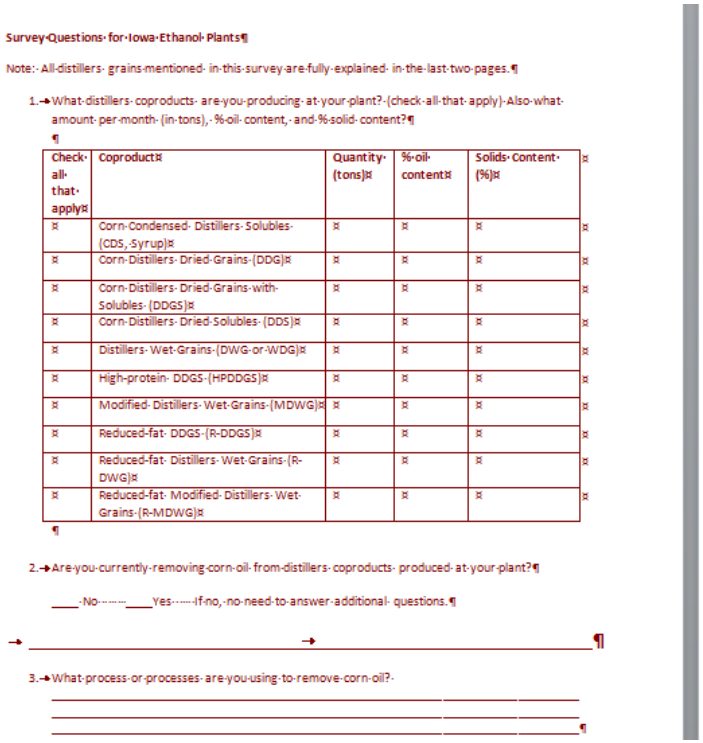
Page Break

1 – Next Steps

- We need your help!!!
- We need livestock producers to complete the survey
- Could you please get the message out?
  - **http://humansciences.ethanolcoproducts.sgizmo.com/s3**

2 – Next Steps

- 2013 U.S. Ethanol Plant Survey
- 19 questions
- Mailed survey June 20 – August 20
- Also need your help!



Survey Questions for Iowa Ethanol Plants

Note: All distillers grains mentioned in this survey are fully explained in the last two pages.

1. What distillers coproducts are you producing at your plant? (check all that apply) Also what amount per month (in tons), % oil content, and % solid content?

Check all that apply	Coproduct	Quantity (tons)	% oil content	Solids Content (%)
	Corn Condensed Distillers Solubles (CDS, Syrup)			
	Corn Distillers Dried Grains (DDG)			
	Corn Distillers Dried Grains with Solubles (DDGS)			
	Corn Distillers Dried Solubles (DDS)			
	Distillers Wet Grains (DWG or WDG)			
	High protein DDGS (HPDDGS)			
	Modified Distillers Wet Grains (MDWG)			
	Reduced fat DDGS (R-DDGS)			
	Reduced fat Distillers Wet Grains (R-DWG)			
	Reduced fat Modified Distillers Wet Grains (R-MDWG)			

2. Are you currently removing corn oil from distillers coproducts produced at your plant?

____ No ____ Yes ... If no, no need to answer additional questions.

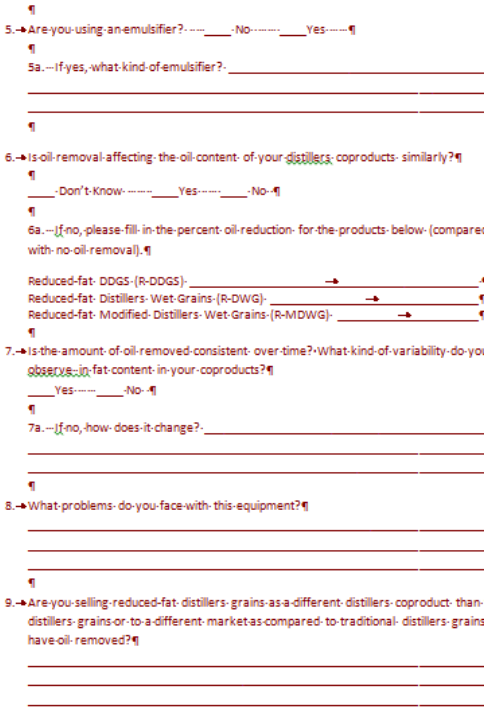
→ _____ →

3. What process or processes are you using to remove corn oil?

_____

_____

_____



5. Are you using an emulsifier? ____ No ____ Yes

5a. If yes, what kind of emulsifier? _____

6. Is oil removal affecting the oil content of your distillers coproducts similarly?

____ Don't Know ____ Yes ____ No

6a. If no, please fill in the percent oil reduction for the products below (compared with no oil removal).

Reduced fat DDGS (R-DDGS) → _____

Reduced fat Distillers Wet Grains (R-DWG) → _____

Reduced fat Modified Distillers Wet Grains (R-MDWG) → _____

7. Is the amount of oil removed consistent over time? What kind of variability do you observe in fat content in your coproducts?

____ Yes ____ No

7a. If no, how does it change? _____

8. What problems do you face with this equipment?

_____

_____

_____

9. Are you selling reduced fat distillers grains as a different distillers coproduct than distillers grains or to a different market as compared to traditional distillers grains have oil removed?

_____

_____

_____

3 – Next Steps

- Need DDGS samples from beverage alcohol production
  - Compare DDGS to DDGS
  - Potential
    - Food grade applications
    - Pet food applications
    - Other value-added applications

Conclusions

- Feedback gained from these surveys will be used to help improve coproduct quality
  - Can help ethanol plants understand their customers
  - Can help livestock producers with their feed costs and livestock performance

Acknowledgements

- The author would like to thank the following:

FUNDING

- Distillers Grains Technology Council
- Renewable Fuels Association
- National Corn Growers Association
- Iowa Corn Promotion Board
- Nebraska Corn Board
- Iowa State University
- Iowa Beef Council
- USDA-ARS

COLLABORATORS

- Alvaro Garcia
- Ken Kalscheur
- Russ Euken
- Bailley Richardson
- Jessica Saunders

Thank you!

Any questions?

Kurt A. Rosentrater, Ph.D.
Assistant Professor
Department of Agricultural and Biosystems Engineering
Iowa State University
karosent@iastate.edu